THE INTERNATIONAL MAGAZINE OF METHODS FOR ENGINEERING/OPERATING PEOPLE

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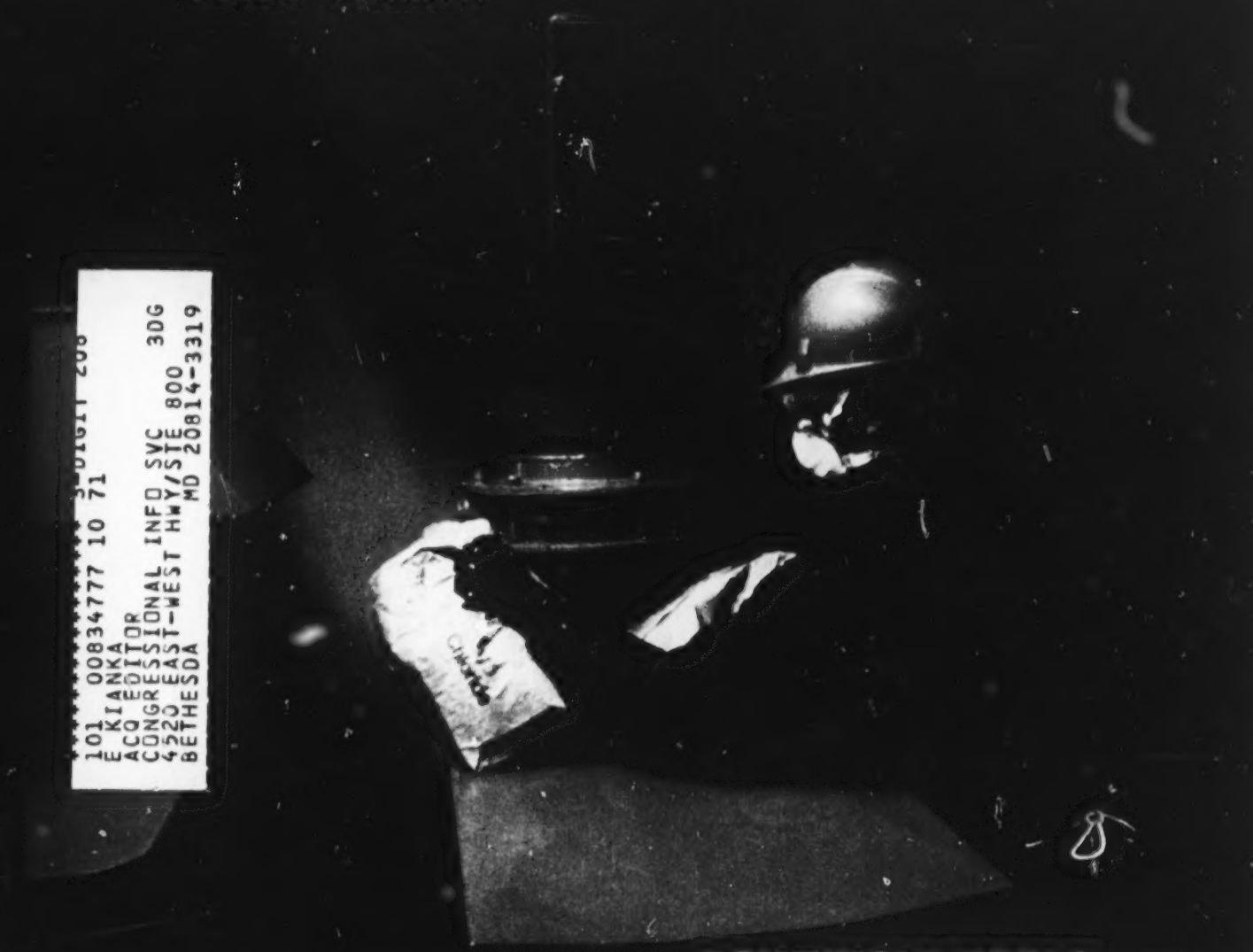
Petroleum Engineer INTERNATIONAL

APRIL 1985 • $3.00 PER COPY



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DOWNHOLE TOOLS AND TECHNOLOGY

How To Prevent Gas Migration, p. 21

Making The Most of Gas Lift, p. 26

An Independent's View Of Downhole Technology, p. 37

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U.S. Rig Count Drops Below 2,000 in Mid-March

The U.S. rotary rig count dropped below the 2,000 mark in mid-March as drilling budgets continued to feel the effects of falling prices for oil and gas, as well as negative vibrations from tax men at both the federal and state levels.

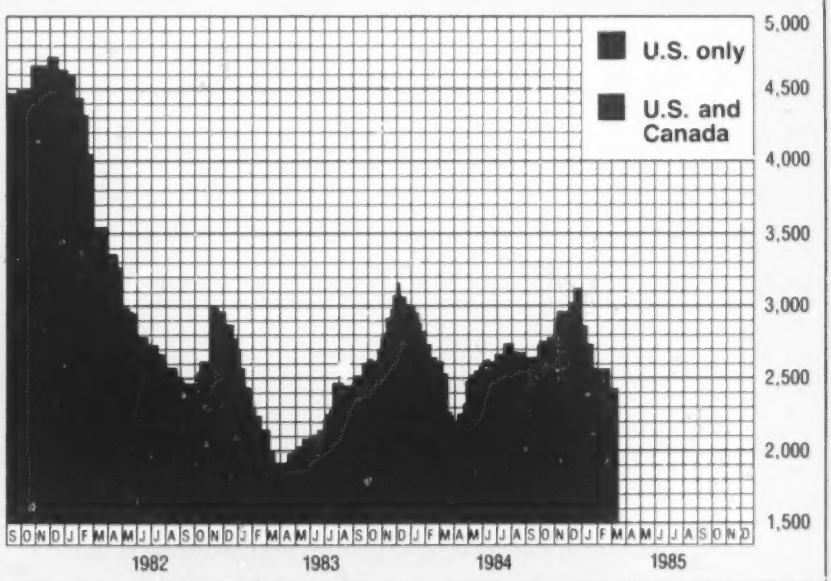
Dramatic drilling declines in Illinois, Indiana, and Ohio during early March, however, are something that happens almost every year as springtime thaws make clay-based roads in the area virtually unpassable. The situation is expected to improve this month.

Canadian drillers, on the other hand, do their best work during the springtime, and this year is no exception. The 415-rig count in Canada on March 4 is the highest total for that country since March 16, 1981.

Rotary rigs actually making hole in the United States and Canada

As reported to International Association of Drilling Contractors by Hughes Tool Co.

	Feb. 18, 1985	Feb. 25, 1985	Mar. 4, 1985	Mar. 11, 1985
Alabama				
Land	9	14	15	16
Inland Waters	2	2	2	2
Offshore	6	5	5	6
Total	17	21	22	24
Alaska				
Land	10	17	16	16
Offshore	7	6	6	6
Total	26	23	22	22
Arkansas	27	28	25	28
California				
Land	60	60	57	55
Offshore	19	19	19	18
Total	88	79	76	73
Colorado	50	50	51	57
Florida				
Land	4	4	5	3
Offshore	1	2	2	2
Total	5	6	5	5
Hawaii	1	1	0	0
Idaho	2	2	2	2
Illinois	35	20	6	8
Indiana	6	7	0	2
Kansas	96	92	76	90
Kentucky	5	3	5	6
North Louisiana	30	32	31	27
South Louisiana				
Inland Waters	50	45	42	42
Land	93	90	96	101
Offshore	140	133	129	126
Total	313	300	298	296
Michigan	36	37	39	26
Mississippi	34	36	34	29
Montana	17	19	23	25
Nebraska	6	8	5	3
Nevada	4	3	3	2
New Mexico	69	71	68	69
New York	5	6	3	3
North Dakota	32	36	32	23
Ohio	52	44	34	15
Oklahoma	266	270	243	228
Oregon	1	0	0	0
Pennsylvania	46	49	42	38
South Dakota	5	1	1	0
Texas				
Offshore	59	62	66	68
Inland Waters	8	5	5	3
Dist. 1-S. Central Tex.	17	18	17	17
Dist. 2-Middle Tex.	32	33	32	30
Dist. 3-Upper Tex.	87	88	87	83
Dist. 4-Lower Tex.	82	80	87	83
Dist. 5-Northeast Tex.	30	38	30	33
Dist. 6-Far Northeast Tex.	58	56	50	47
Dist. 7B-N. Central Tex.	48	52	50	51
Dist. 7C-W. Central Tex.	57	60	52	47
Dist. 8-Far West Tex.	134	139	134	126
Dist. 8A-West Tex.	74	67	69	65
Dist. 9-North Tex.	46	48	46	46
Dist. 10-Tex. Panhandle	40	37	35	38
Total	772	783	760	737
Utah	35	36	29	27
West Virginia	20	25	22	19
Wyoming	91	87	85	77
Total U.S.	2,162	2,143	2,011	1,934
Canada				
Land	388	389	406	404
Offshore	13	9	9	11
Total Canada	402	398	415	415
U.S. and Canada	2,564	2,541	2,426	2,349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APRIL 1985 NUMBER 4 VOLUME 57

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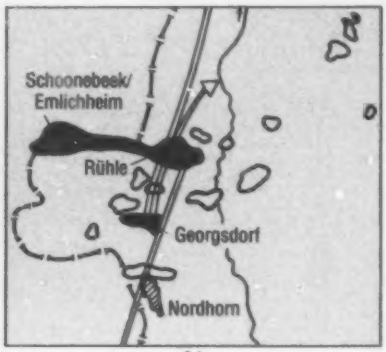

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DOWNHOLE TOOLS AND TECHNOLOGY

Conoco Stops Annular Gas Flow With Special Cement 21

by Don Stehle, Conoco Inc., and Fred Sabins, Jim Gibson, Karl Theis, and J.J. Venditto, Halliburton Services. Many wells put on production since 1975 were experiencing annular gas flow between intermediate and production casing.

Gas Lift: How To Make The Most Of It, Part 1 26

by Richard F. Keelan, The Moran Corp. Variations in independent correlations can be significant because of specific flow rates, tubing sizes, water cuts, and other conditions for which predicted gradients better match measured conditions.

The Independent's Role In Developing Downhole Technology 37

James F. Massey, a vice president of Hamon Oil Co. of Dallas, wonders whether the industry will be able to afford the costs associated with development of the latest downhole technology because of the depressed prices of both oil and gas.

New Method Estimates Well-Treatment Volumes 38

by H.W. Bang, Phillips Oil Co. Treatment volumes larger than needed can be wasteful, so optimum volumes are determined mathematically, as are the most economical concentrations of chemical additives for the area of the reservoir being treated.

How To Apply The New API Adjustment For Collapse Resistance 44

by Phillip D. Patillo, Amoco Production Co. Determining tubular collapse resistance usually is a two-step process – first, without axial load, and then adjustments to account for tension or compression. Conclusion of a two-part report.

What's New... In Downhole Tools and Technology 56

An economical alternative to other high-density gravel pack techniques is outlined this month, as are a positive displacement pump that is powered by a hydraulic unit on the surface and one of the industry's most reliable inflatable packers.

Engineers Solve Excess Water Problems in German Steam Drive Areas 64

by R. Mueller and F.P. Springer, BEB. Reverse osmosis and distillation are used in several installations to desalt seawater. A third process, desalting by freezing, is in the experimental stage. This process requires an aftertreatment.

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ABOUT THE COVER: A technician mans an enclosed mud hopper that is vented to prevent the spread of dust. Such hoppers are standard equipment in the Keydril rig fleet.

NEXT MONTH: Offshore technology will be the theme of the May issue, in keeping with the annual Offshore Technology Conference held in Houston each May.

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OFFSHORE TECHNOLOGY

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Platform Inspection, p. 30

Bit Analysis, p. 72

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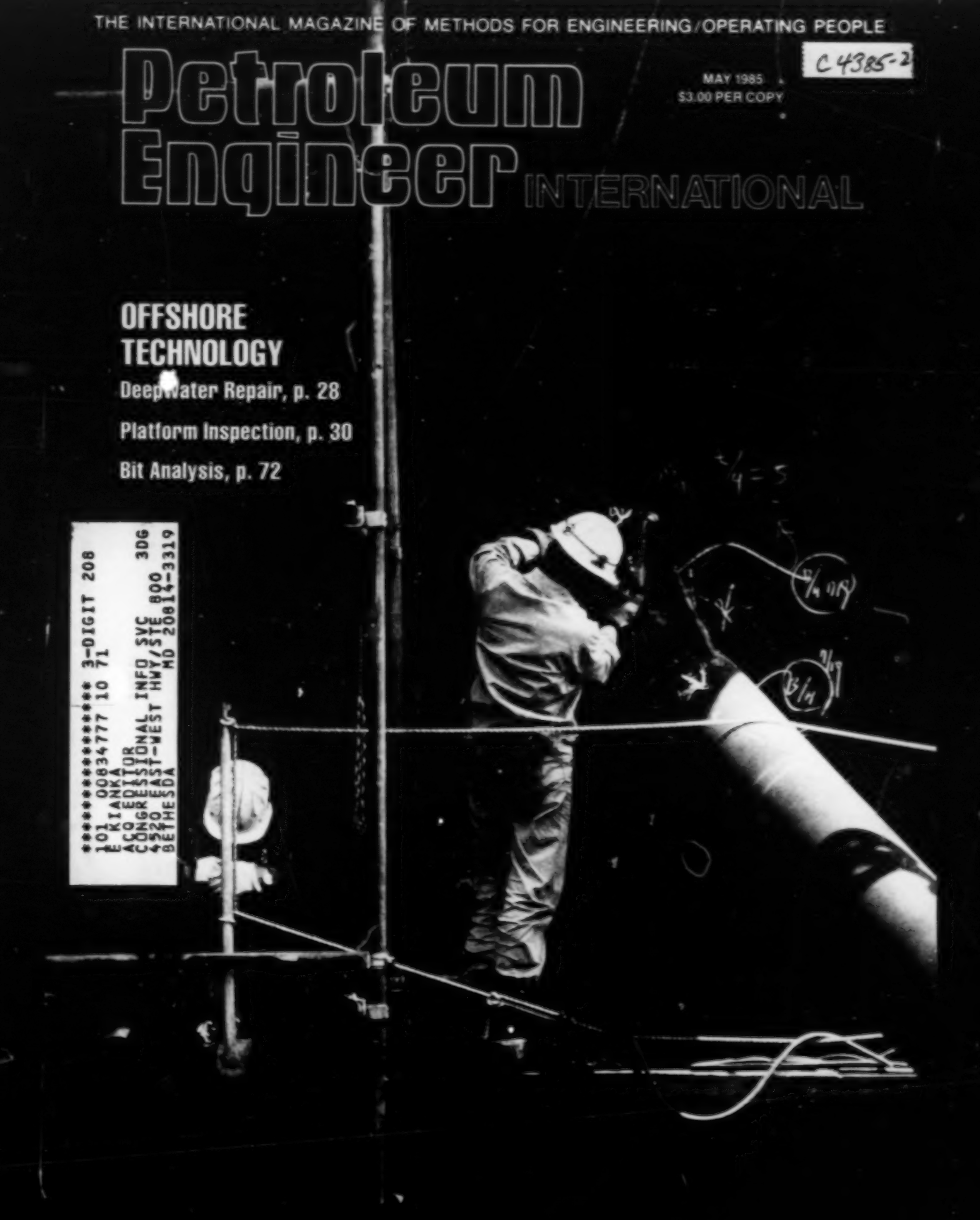

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Thaw Slows Canadian Drillers

The spring thaws arrived on schedule in Canada this year resulting in an abrupt 56.5% decline in drilling activity north of the border during the mid-March to mid-April period covered by this report.

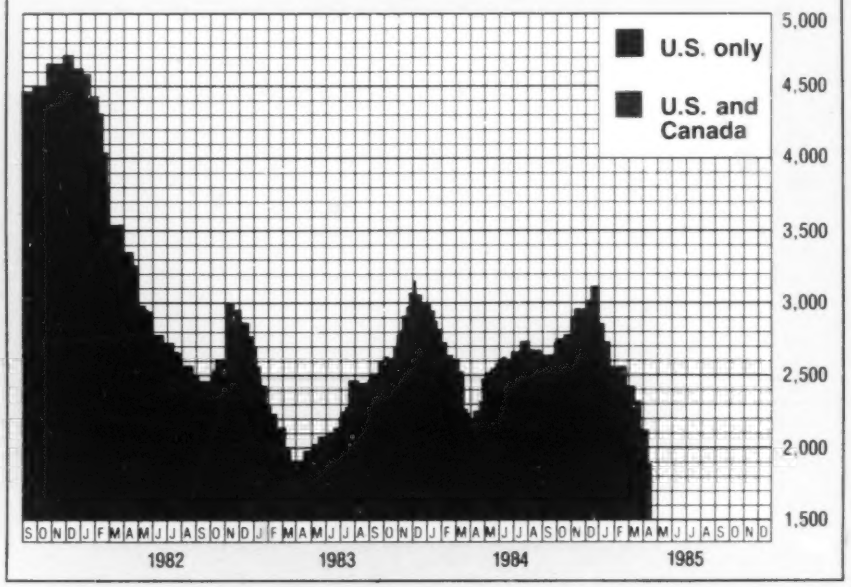
In the U.S., meanwhile, the drilling decline has been less spectacular. But it has been going on all year, and has now reached 26%, with close to 700 rigs idled since the beginning of 1985. More than 200 of the idled rigs are in Texas.

The U.S. rotary rig slowdown has been largely limited to onshore activity. Only 13% of the decline occurred offshore, where the rig count is down by 32 since the beginning of the year.

Rotary rigs actually making hole in the United States & Canada

As reported to International Association of Drilling Contractors by Hughes Tool Co.

	Mar. 18, 1985	Mar. 25, 1985	Apr. 1, 1985	Apr. 8, 1985
Alabama				
Land	14	16	14	12
Inland Waters	2	2	2	0
Offshore	6	6	6	9
Total	22	24	22	21
Alaska				
Land	15	16	16	16
Offshore	5	5	5	5
Total	20	21	21	21
Arkansas	30	30	29	24
California				
Land	58	64	65	65
Offshore	12	11	10	8
Total	70	75	75	73
Colorado	56	49	56	54
Florida				
Land	3	3	3	3
Offshore	2	2	2	2
Total	5	5	5	5
Idaho	2	2	1	1
Illinois	9	13	15	16
Indiana	2	3	3	3
Kansas	99	99	86	84
Kentucky	4	4	5	5
North Louisiana	25	22	21	25
South Louisiana				
Inland Waters	38	42	47	40
Land	93	83	87	92
Offshore	136	133	136	130
Total	292	280	291	288
Michigan	11	11	10	7
Mississippi	32	29	33	26
Montana	25	21	22	19
Nebraska	3	3	5	5
Nevada	2	3	4	4
New Mexico	63	63	70	69
New York	4	0	2	0
North Dakota	23	37	34	35
Ohio	13	37	17	10
Oklahoma	249	259	250	271
Pennsylvania	38	30	31	26
Texas				
Offshore	61	57	61	57
Inland Waters	4	3	3	3
Dist. 1-S. Central Tex.	17	14	14	15
Dist. 2-Middle Tex.	28	24	23	23
Dist. 3-Upper Tex.	82	81	78	83
Dist. 4-Lower Tex.	76	72	73	70
Dist. 5-Northeast Tex.	32	31	32	35
Dist. 6-Far Northeast Tex.	45	47	48	41
Dist. 7B-N. Central Tex.	50	50	42	46
Dist. 7C-W. Central Tex.	49	51	60	50
Dist. 8-Far West Tex.	126	129	115	113
Dist. 8A-West Tex.	70	67	66	66
Dist. 9-N. Tex.	53	47	41	50
Dist. 10-Tex. Panhandle	42	41	37	37
Total	735	714	693	689
Utah	28	29	22	27
Virginia	0	0	0	2
W. Virginia	25	30	32	32
Wyoming	75	82	74	81
Total U.S.	1,937	1,939	1,910	1,898
Canada				
Land	393	339	227	166
Offshore	7	7	8	8
Total Canada	400	346	235	174
U.S. and Canada	2337	2285	2145	2072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OFFSHORE TECHNOLOGY

Drillers Hopes Riding On "Last Frontier" 21
by Rich McNally, Associate Editor. Offshore is where it's at. Particularly in view of the fact that the inventory of drillable offshore leases has increased significantly, especially in the Gulf of Mexico and offshore northwestern Europe.

Deepwater Repair Capability Extended To 8,000 Ft 28
by M.A. Stevenson, D.C. Beebe, and R.D. King, Gulf Oil Exploration and Production Co. A system for the repair of deepwater flow lines and pipelines also appears to be a viable alternative to hyperbaric welding in shallower water depths.

Platform Inspection And Maintenance: An Expensive Necessity 30
by W.B. Bleakley, Editor. Platforms in water depths to 300 or 400 ft generally are inspected by divers. Those in deeper waters require the use of ROVs or 1-atm diving suits. Saturation diving for platform inspection is rare because of high costs.

Gas Lift: How To MakeThe Most Of It 44
by Richard F. Keelan, Morgas Intrastate Gas Co. A plunger occasionally is used in intermittent lift operations to minimize liquid fallback from the liquid slug. Usually, a small fluid column can benefit from the greater efficiency of a plunger installation.

Modern Production Risers 56
by George W. Morgan, Engineering Consultant. This is the conclusion of a 16-part series, and it points out that all engineering and management personnel involved in riser test programs should agree on the worded form of the objectives before the test begins.

Quick TI Program Calculates Surge Pressures 66
by W.R. Matthews, Engineering Consultant. A simple program developed for the TI-59 hand-held calculator determines the equivalent circulating densities at the casing seat and drill bit as the drill string is run in the hole.

How To Analyze Bit Records To Increase Penetration Rates 72
by Samuel L. Hawkes, Smith Tool. A bit record analysis worksheet has been developed to help determine where improvements might be made and what their impact might be on penetration rates. It also will help in preparing a recommended bit program.

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ABOUT THE COVER: Activities offshore are as varied as they are unusual, but the common denominator is technology. (Photo courtesy of Sedco Forex)

NEXT MONTH: The June issue looks at drilling and production from an international point of view, with reports from a variety of regions outside the U.S.

Shakeout Predicted For Service Industry

The level of worldwide drilling activity, and U.S. drilling in particular, is headed for a more severe decline than has generally been predicted, according to a recent analysis by Kevin M. Conboy of E.F. Hutton & Co. Inc. of New York.

As a result, Conboy looks for the petroleum service industry to be "headed toward the shakeout that is required to reduce industry capacity and weed out the weaker market participants."

The duration of intensive price competition and depressed levels of drilling activity, the E.F. Hutton analyst said, will largely be determined by the psychology of the oil industry regarding oil prices. "We believe," he said, "that the petroleum industry is now just beginning to recognize that market forces, not OPEC, will dictate the level of oil prices. In essence, oil companies, reluctantly, are beginning to perceive that OPEC is not an effective cartel. This change in attitude is bound to eventually create a reevaluation of long-term corporate strategies regarding the deployment of oil industry cash flows and drilling expenditures."

Long-term strategies developed by major oil companies during 1982 and 1983, Conboy said, were based on an oil price of at least $29/bbl. This resulted in, "acquisition of domestic reserves via the stock market which, in some cases, resulted in major increases in long-term debt; acquisition of substantial deepwater acreage in the Gulf of Mexico; a return to exploration in the North Sea; onshore acreage acquisition in deep gas basins, such as the Anadarko; a willingness to pursue expensive frontier exploration in Alaska and other frontier areas offshore; and, in some cases, substantial repurchases of company common shares."

Now, however, there is a growing risk that oil prices may not stay above the $25/bbl level during the next 2 years. And that, Conboy pointed out, raises serious questions regarding previous scenarios for oil prices.

Questioning of past assumptions regarding future oil prices on the part of major oil companies could result in much lower drilling budgets than previously planned for 1985 and 1986, Conboy said. And he went on to predict that drilling activity in the U.S. this year could decline to 2,120 rigs working, 265 million ft of hole drilled, and drilling expenditures of $17.9 billion. His forecast is based on:

- A more cautious attitude toward exploration by the major oil companies due to increased recognition that oil prices could drop below $25/bbl during 1985-86. The same is even more valid for independent oil company spending.
- Continued weak market conditions for domestic natural gas, both in terms of price and demand, which should continue to discourage gas drilling.
- Lower producer cash flows due to declines in average oil and gas prices in 1985.
- A reduction in outside funding for oil and gas as banks and individual investors become increasingly apprehensive regarding future oil prices. In addition, tax-shelter-related monies may also be hard to come by due to concerns regarding the prospect of a flat tax.

TABLE 1. U.S. drilling activity during the first half of this decade

Year	Estimated wellhead revenues, billions	Estimated plowback, %	Estimated drilling expenditures, billions	Estimated footage drilled, millions	Rigs working	Estimated cost/ft drilled
1981	$110	34.2	$37.6	400	3,970	$94
1982	115	23.7	27.3	355	3,106	77
1983	112	17.2	19.3	280	2,232	69
1984	115	18.8	21.6	304	2,428	71
1985	110	16.3	17.9	265	2,120E	67.50

Source: American Petroleum Institute and E.F. Hutton estimates.

A prominent assumption in E.F. Hutton's 1985 earnings estimates for oil service companies is that price discounting will intensify as drilling activity declines. And the odds, Conboy said, favor a 1985 seasonal low point for active U.S. rigs to be in the 1,750 to 1,800 range, "somewhat below the low point reached in the spring of 1983 after OPEC cut oil prices by $5/bbl." (At this writing, in late March, the U.S. rig count is only slightly higher than 1,900.)

E.F. Hutton looks for the rate of recovery in domestic drilling activity to be slow and gradual "due to the likelihood that uncertainty regarding future oil prices will persist. Moreover, we are not very optimistic that drilling activity in the latter part of 1985 will experience its seasonal surge that usually is prompted by year-end tax planning considerations."

A 13% decline in average rigs working in the U.S. is likely to result in a further widening of price discounts for oil services and products in 1985. In E.F. Hutton's view, as drilling activity declines and remains depressed, the low cost factors in various oil service markets may increase price discounting in order to gain a greater share of a declining market. "This is particularly the case in such high-fixed-cost segments (of the market) as well logging and pumping services.

"Certainly in the case of well logging, which we attach the greatest odds to a widening in price discounting, a significant decline in demand for wireline services could lead to more aggressive price concessions.

"In the case of pumping services, a further decline in drilling activity and persistence of depressed levels of activity may result in a further widening in discounts. Already, there are indications that U.S. pumping service discounts have increased, resulting in margin pressures."

Essentially, what the E.F. Hutton report says is that, the longer drilling activity remains depressed, the greater the likelihood of increased oil service price discounting. In addition, discounts can be expected to become increasingly more aggressive as the decline in activity gets steeper.

Regarding 1986, the report is not any more hopeful about oil prices, "although the time and magnitude of future declines remain uncertain. The following events," the report said, "will certainly pose challenges to OPEC:

- The end of the UK coal workers strike, which reduces demand for OPEC oil.
- Increased Iraqi production and exports as pipeline export capacity comes on stream outside of the Persian Gulf.
- Continued growth in OPEC export refining capacity, putting a further downward pressure on European and U.S. downstream margins.
- A significant decline in the value of the dollar, thereby eroding OPEC's purchasing power and creating incentives for increased oil exports.
- The seasonal uptick in oil demand in the fourth quarter of 1985, which could create instability as individual OPEC members strive for market share.
- Seasonal declines in oil demand in the spring and summer of 1986.
- And the next economic recession.